

FIRE IN SOUTHWESTERN PONDEROSA PINE FORESTS: A BIRD'S-EYE VIEW

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Mention of the American Southwest typically conjures images of dry, dusty, desert landscapes teeming with all things slithery and spiny. Yet the familiar scrubby desert of movie stardom is restricted to arid, low country within the rugged Southwestern landscape. Throughout Arizona, hills, plateaus, and mountains that penetrate into milder climates support lush grasslands, evergreen woodlands, and even conifer forests. These forests generally occur above 7,000 feet in elevation and are often dominated by ponderosa pine, which is one of the most drought-tolerant tree species found in the American West. This pine thrives under the relatively warm and dry conditions that characterize much of Arizona's forestland, including lands on the Kaibab Plateau, in the White Mountains, and atop the "sky islands" that pepper the southeastern part of the state.

Arizona's ponderosa pine forests house a spectacular array of native plants and animals. Southwestern white pine, Douglas-fir, white fir, and quaking aspen may mingle with the dominant ponderosas in certain stands. Patches of small trees like Gambel oak and New Mexican locust and shrubs including ceanothus, creeping mahonia, gooseberry, elderberry, snowberry, and rockspirea are common. Wildflowers, grasses, and ferns often carpet the forest floor, especially in more open stands. Scores of insects and spiders live within the nooks and crannies of forest vegetation and leaf litter. The plants and insects support lizards and a host of mammals from bats to bear as well as a striking diversity of resident and migratory birds, which in turn support common predators like snakes and squirrels. Remarkably, the nature of these vivacious woods has long been shaped by a force that is usually associated with forest destruction. That force is fire.

Southwestern ponderosa pine forests occur in one of the most fire-prone environments in North America. Each year, before summer rains begin, dry lightning storms may set the tinder-dry woods on fire. These fires tend to creep along in the underbrush, scorching or consuming litter, woody debris, and low vegetation. Whenever a ladder of branches allows flames to reach the treetops or a mass of debris allows fire to burn long and hot enough to pierce the thick bark of tree trunks, large old pines may be weakened or killed. Left to her own devices, Mother Nature would set fire to nearly every stand of trees about once every decade. Such frequent fires check the growth of small trees and the buildup of litter and woody debris at the forest floor, which in turn, discourages crown fire (fire in the treetops) and minimizes damage to mature trees. More time between burns in ponderosa pine forests generally leads to more severe (damaging) fires.

Efforts to extinguish wildfires have increased the likelihood that, when a fire inevitably occurs, it will be more severe – sweeping through tree crowns instead of creeping through forest understories. The behavior of recent wildfires like the 2000 Cerro Grande Fire near Los Alamos, New Mexico and the 2002 Rodeo-Chediski Fire in Arizona appears to support this argument. The apparent shift from frequent, understory burns to infrequent, crown fires in Southwestern ponderosa pine forests is worrisome for a number of reasons. First and foremost, crown fires are more difficult to control and are more

likely to threaten peoples' lives and property. In addition, crown fires can damage acre upon acre of merchantable timber and may increase rates of soil erosion. Furthermore, the abilities of particular forest plants and animals to persist over the long-term in the face of a shift toward more severe fires are largely unknown. Some scientists predict that many Southwestern forests will be converted to grasslands or shrubfields by the most severe crown fires.

In light of the undesirable consequences of fire exclusion, many have welcomed the return of fire to ponderosa pine forests by way of the prescribed burn. Over the past few decades, federal, state, and private land managers have deliberately burned millions of acres of forested land in the Southwest. Most intend prescribed fires to mimic Mother Nature's historic burning patterns as closely as possible, thereby reducing the risk of crown fire and maintaining populations of plants and animals under the same conditions that they have experienced for centuries or even millennia. However, it is tricky to set fire to the woods during the height of the historic fire season, which occurs in the dangerously dry late spring and early summer. Instead, prescribed fires are commonly set outside the historic fire season and, for other logistical reasons, with lower frequency and severity than known precedents. It is unclear how these departures from the historic fire regime affect forest plants and wildlife.

To learn how patterns of prescribed burning affect forest plants and animals, some researchers have turned to national parks and monuments with active fire programs for use as natural laboratories. One of these scientists is Karen Short, a doctoral student at The University of Montana. Since 1998, Karen has been studying the effects of Fall prescribed burns in ponderosa pine forest within Arizona's Grand Canyon National Park, Walnut Canyon National Monument, and Saguaro National Park. Her work focused on one sparrow-like bird that is closely tied to the forest understory, the junco. Both Dark-eyed and Yellow-eyed Juncos, the two species in her study, nest and feed on or near the ground and should be very sensitive to the way in which prescribed understory burns are conducted.

Many scientists contend that Fall burning in ponderosa pine forests has a lesser impact on populations of ground-nesting birds, like juncos, than would fires set during the historic fire season (May-June), which coincides with the peak nesting period for forest birds in the Southwest. While this may be true (no one has actually made this comparison), Karen was still interested in how fall burning affects the birds. While fires in October would not kill young birds in nests, the burns could still affect junco reproductive rates in years that follow by changing the availability of food or prime nesting sites. If the Autumn burns reduced the quality of her 100-acre study plots for breeding, Karen expected to find fewer juncos using the areas during the summer after burning (relative to unburned comparisons). If the fires enhanced the quality of the plots, she expected an increase in junco numbers. As a more direct assessment of the quality of Fall-burned forest for breeding juncos, she documented the fate of each nest she could find within her Saguaro National Park study area.

Karen found that although the total number of adult juncos detected within her study plots tended to fall in response to the burn treatments, the number of birds holding breeding territories at Saguaro did not change. The fire at Saguaro did, however, cause nesting success to fall by about 75% during the first summer. Reproductive rates on the burned site climbed back to the prefire level by the second summer following the fire. Karen assumed that these "bust" and then "boom" breeding seasons were caused by changes in the availability of food or safe nesting sites, or both. Because juncos feed primarily on insects and spiders when nesting, Karen monitored junco feeding rates and collected hundreds of thousands of insects and spiders throughout her study plots before and after the fires to test for changes in prey availability caused by burning. She found no evidence that there were fewer prey or that the fires made it harder to catch these items. Instead, she concluded that the fires affected junco nesting success by reducing the availability of safe nest sites. Throughout her study juncos preferred to nest in patches of heavy grass and fern cover. Nests in these sites were more successful than nests placed in less "grassy" areas, presumably because the grassy nests were better protected from predators. The Saguaro fire caused a dramatic first-year decrease in grass cover, followed by a marked second-year flush in production. By causing grass cover to fall then rise, the fire at Saguaro apparently caused the abundance and nesting success of juncos to likewise fall then rise in the two years following prescribed burning.

Karen found that changes in grass cover and junco numbers affected by the fires at Grand Canyon and Walnut Canyon were modest in comparison to the changes caused by the Saguaro burn. She deemed it necessary to document the effects of many more fires before drawing general conclusions regarding their effects. Yet she found that even when she assumed that her findings from the Saguaro study site were typical of all fires and developed population growth models in which fires caused "bust" then "boom" years in nesting success over a 100-year period of repeated burning, her computer-generated junco populations were able to persist in the face of fires on the order of every decade. This finding suggests that even if all fires caused dramatic short-term fluctuations in nesting success, frequent Fall burns would not be detrimental to junco populations in the long run.

Studies like Karen's shed light on the often-complex relationships between fires' effects on forest plants and animals. Additional research along these lines will help land managers tailor prescribed burning programs to ensure the persistence of native vegetation and wildlife in ponderosa pine forests. Each fire set in the natural laboratories of Southwestern parks and monuments is a means to that end.